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OCTOBER 31, 1988

CHEMICAL & ENGINEERING

NEWS

Research on medical uses of metalloporphyrins advances
Page 18

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Western Chemistry Comes to Japan: A Historical Account Page 26

CHEMICAL & ENGINEERING
NEWS

Volume 66, Number 44
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OCTOBER 31, 1988

News of the Week

■ **Congressional task force suggests ways the government and Congress can help U.S. industry regain its competitive edge in technology both domestically and globally.** **Page 4**

■ **The Soviet Union has granted physicist and human rights leader Andrei D. Sakharov permission to visit the U.S. next week.** **Page 5**

■ **Ciba-Geigy's request for a permit to build a drug plant at its Toms River site has been turned down by the New Jersey Department of Environmental Protection because of toxic waste problems at the site.** **Page 5**

■ **Procter & Gamble plans to test market a plastic bottle made from recycled polyethylene terephthalate.** **Page 6**

■ **Atlantic Richfield may spin off its Lyondell Petrochemical subsidiary into a publicly held company.** **Page 6**

Cover: The Seimikyoku ("school of chemistry") established by Koenraad Gratama at Osaka, Japan, in 1869 is depicted in a woodblock print by Sadanobu Hasegawa

Letters 2

Concentrates
Business 7
Government 11
Science/Technology 17

The Departments
ACS News 48
People 50
Newscripts 68

Business

Increasing demand for styrene triggers spate of plans for capacity expansions that will add at least 3.3 billion lb by 1992. **Page 9**

Government

End-of-session Congressional actions of interest to the chemical community include enactment of a drug bill, a tax bill that extends the R&D tax credit, and NSF's authorization bill. **Page 12**

Congress and the Reagan Administration initiate a number of new programs to fight the AIDS epidemic. **Page 16**

Science

Metalloporphyrin research makes strides in biomedical applications with ^{67}Cu- and ^{10}B-labeled molecules among compounds showing promise in diagnostic imaging and cancer therapy. **Page 18**

Cleaner route to cyclic sulfate esters of 1,2-diols developed by chemists at Massachusetts Institute of Technology. **Page 22**

Technology

Researchers discover catalysts that enable heterocyclic olefins to polymerize more readily in water than in organic solvents. **Page 23**

A number of new hardware and software products were introduced at the recent ACS exposition in Los Angeles. **Page 24**

Books

"**Interactions:** A Journey Through the Mind of a Particle Physicist and the Matter of This World," by Nobelist Sheldon L. Glashow, fails as both interesting autobiography and particle physics primer. **Page 42**

Special Report

The introduction into Japan of western-style chemical education and industrial-scale chemical production was accomplished by Dutch physician/chemist Koenraad Gratama, who died 100 years ago. **Page 26**

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LETTERS

Chemists in the popular press

SIR: An article in the Oct. 4 issue of the *Arkansas Gazette* summarized a number of major breakthroughs announced at the national ACS meeting in Los Angeles. This is the first time that I can recall seeing such an article in the popular press, except for articles in the cities where meetings are held. The article, which had a Gannett News Service byline, described genetic fingerprinting, a new cancer therapy, superconductor advances, and an artificial lens for eye implantation. These are topics that catch the attention and imagination of the public. Although it is gratifying to see an article highlighting an ACS meeting, it is disturbing to realize that only one time are chemists mentioned. Nowhere in the article are chemists given credit for the contributions that they have made to these fields.

There is a need for more articles in the popular press highlighting the accomplishments of chemists and chemistry. This is not just to pat ourselves on the back. The prosperity of our society depends on continued technological advances. The quality of science and engineering students seems to be gradually falling. This may be because salaries and prestige have fallen behind that of many medical and business professions. Few people have any idea what chemists do. No student is going to consider entering a field about which he or she knows nothing. One way to convince bright students that chemistry is a viable career choice is to show them what chemists are accomplishing today, at the forefront of technology. ACS simply must become more effective at getting the national press to recognize these accomplishments.

But, it is not only up to the national ACS. Each member and each section has a role to play also. Last November this institution hosted the Ouachita Valley Section's National Chemistry Day program. We worked hard to make it a success. Hundreds of school children, college students, and members of the general public had an opportunity to see some of the ways that they benefit from chemistry. The resulting newspaper and television coverage brought a positive impression of chemistry to many more. In talking with members of other sections, I was very disappointed to find that few other sections in this area did anything to promote chemistry to the general public.

As individuals there is much that we can do. Our chemistry faculty members frequently perform demonstrations in public schools in a 10-county area. This is obviously a recruiting effort, but we also expose many students to the fun side of chemistry. We take every opportunity to perform demonstrations during campus events such as parents' day and homecoming, just to present a positive image of chemistry to a portion of the general public.

The attitude of many academic chemists is, "Leave me alone and let me do my research." The irony is that unless the general public, state legislatures, and Congress are convinced that what we do is meaningful, research funds will eventually dry up. It is up to chemists, individually and collectively, to promote our science, which has benefited so many people in so many ways. We must do a better job.

Thomas A. Ekman
Assistant Professor of Chemistry
Southern Arkansas University

Erroneous data

SIR: I am writing to correct erroneous data in the report on facts and figures for chemical R&D (C&EN, Aug. 22, page 29). The table on page 63 bears the headline, "University of Texas makes big jump into top 10," and the data contained in the table indeed show a change in rank from 27th to fifth in spending on chemical R&D.

This impressive leap is actually the consequence of propagation of an error in the data on which the report for 1985, published in the July 27, 1987, issue of C&EN, was based. As noted in a letter published in C&EN last fall, our total research funding in that reporting year was $7.908 million so that our ranking actually should have been sixth rather than 27th. UT Austin thus has moved up only one place in the rankings rather than the 22 places indicated. Given the corrected figure for 1985 research funding, the annual change from 1985 to 1986 is 8% rather than the 86% shown in the table.

The table on page 64 also reflects the erroneous reporting for 1985. Our feder-

Correction

• Sept. 19, page 16: Courtaulds sold its interest in a South African wood pulp operation to a consortium represented by Sappi Ltd., a publicly owned South African pulp and paper producer, not to the South African government.

Strong Demand for Styrene Spurs Capacity Expansion

Spate of plans announced by four of eight major producers of the monomer will add about 3.3 billion lb to capacity over next three years

Bruce F. Greek, C&EN Houston

Utilization of all styrene plant capacity, a binge of new plant construction, and expansions of existing plants are enlivening the status of this mature petrochemical. Exports of styrene continue to be strong this year, with prices from sales to foreign markets more than doubling. Imports of styrene also have soared as efforts to meet fast-rising U.S. demand have pushed prices up strongly, although not to the high levels of spot export prices.

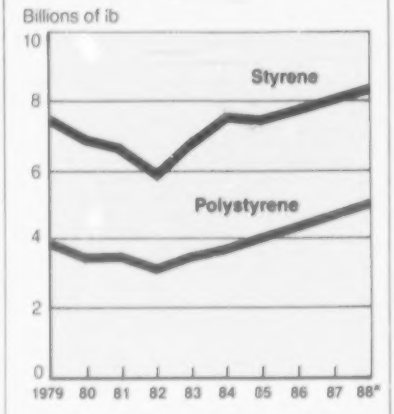
Styrene production this year could reach 8.4 billion lb, almost all the total U.S. capacity of about 8.5 billion lb. U.S. demand for styrene to make derivatives such as the various polymers and copolymers is growing rapidly compared with growth over the past decade. Nevertheless, styrene demand is growing more slowly than that for other basic monomers, such as some of the olefins. With output limited by capacity, further growth in styrene production is expected to be minimal, restricted to levels that can be achieved through debottlenecking of mostly old plants, until at least part of the new capacity is completed.

The binge of capacity expansions announced so far this year will add at least 3.3 billion lb over the next three years. The expansions announced by four of the eight major producers of styrene could add 39% to capacity by the end of 1991. Such potential production growth has not happened since 1983 and 1984, when styrene output was bouncing back from the 1982 recession, at year-to-year growth rates of 15% and 13%, respectively.

Restarting styrene plants that are shut down also could add capacity. Among shuttered plants, only Arco Chemical's plant at Monaca, Pa., has been restarted. That plant was shut down for a relatively short time (only since early 1986), so it could be brought back at reasonable cost. The large increases in selling prices during 1988 might provide incentives to restart a few shutdown units, but costs to restart other styrene plants closed for longer periods would be excessive, say industry sources. Such costs might not be made up before new capacity would come on stream and added competition would reduce current high returns on investment. Sources expect, therefore, that additional styrene production will have to come from new units with updated technology and from limited debottlenecking.

Some industry sources doubt that all the additional announced styrene capacity will be built as scheduled. Some units have 1991 startup dates. Construction of styrene plants can be completed faster than other major plants such as steam crackers. For example, Chevron Chemical expects construction to begin on an

Both styrene, polystyrene output are growing slowly



a C&EN estimate. **Sources:** U.S. International Trade Commission, Committee on Resin Statistics of the Society of the Plastics Industry

Capacity to make styrene will rise substantially

Millions of lb per year	Mid-1988 operating nameplate capacity	Capacity additions and remarks
Amoco Chemicals, Texas City, Tex.	750	
Arco Chemical, Monaca, Pa.	210	Restarted as of March 1988
Arco Chemical, Channelview, Tex.	1310	Studies under way on expansion to 2.31 billion lb
Chevron Chemical, St. James, La.	600	Expanding to 1.5 billion lb by 1990
Cos-Mar, Carville, La.	1500	Expanding to 1.9 billion lb by early 1990
Dow Chemical, Freeport, Tex.	1300	Considering 1 billion lb expansion by 1991-92
El Paso Products, Odessa, Tex.	320	
Huntsman Chemical[a], Bayport, Tex.	1000	
Sterling Chemical, Texas City, Tex.	1500	
TOTAL	**8490**	**Total potential capacity additions 3.3 billion lb**

[a] Operated by Hoechst Celanese

Rising styrene imports lower trade balance

Millions of lb	Exports	Imports	Trade balance
1979	961	38	923
1980	1205	51	1154
1981	1149	28	1121
1982	1025	21	1004
1983	1077	74	1003
1984	1170	102	1068
1985	1330	209	1121
1986	1307	319	988
1987	1130	425	705
1988[a]	1100	550	550

a C&EN estimate. **Source:** Department of Commerce

expansion of its St. James, La., plant in the first quarter of 1989, and to be completed in 1990.

Other major expansions are well into planning stages. Cos-Mar, a joint venture of Fina Oil & Chemical and Borg-Warner, will add 400 million lb of capacity by early 1990. By 1991-92, Arco Chemical will add 1 billion lb of capacity at Channelview, Tex., with 400 million lb of propylene oxide as coproduct. Dow Chemical also is planning to add 1 billion lb of capacity to its Freeport, Tex., plant.

Additional styrene capacity is being added or planned in many other countries. In Canada, for example, Polysar is restarting a 200 million lb-per-year unit at Sarnia, Ontario, with full operation slated by the end of the first quarter of 1989. Most of the production will be marketed in the U.S., Polysar says.

These expansions throughout the world are expected to reduce further net exports of styrene by U.S. producers. For nearly a decade, U.S. styrene exports have hovered around 1 billion lb annually, with imports a tenth (or less) of exports. Imports began to rise rapidly in 1985 as exports declined. This year, the trade balance is forecast at about 550 million lb, less than half of the trade balance three years ago.

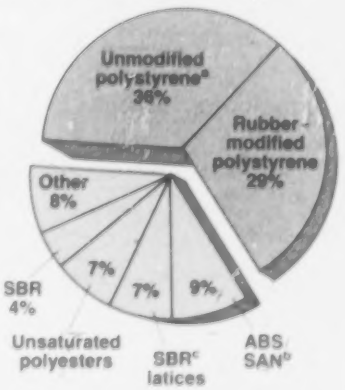
Growth in styrene imports and the decline in exports stem partly from increased demand in the U.S. Some of the increased styrene demand, however, will become exports as derivatives. Growth in exports of polystyrene, for example, has been rapid in the past three years. Outlook for export growth of styrene derivatives, longer term, is uncertain because of capacity growth in derivatives outside the U.S.

Vagaries of export markets for styrene have brought unusual price variations. Spot export prices for styrene reached about 85 cents per lb earlier this year but have dropped back below 60 cents per lb. The average export price during 1987 was 38.2 cents per lb, according to Department of Commerce data. For January through July 1988, the average export price of styrene was 52.4 cents per lb. The current contract price for sales in the U.S. is about 47 cents per lb.

With exports taking about 13% of U.S. styrene output this year, down slightly from last year's share, and with imports, largely from Canada, equal to about half of exports, U.S. consumption of styrene this year will be about 7.9 billion lb. Almost all of that styrene will go into polymers.

Polystyrene dominates consumption of styrene, requiring about 65% of total use. Unmodified polystyrene takes more than a third of consumption and includes two general categories—clear and expandable beads. The clear polystyrene often has additives and pigments in it and is fabricated by various molding and extrusion methods to make a wide variety of consumer products such as packaging items, housewares, and toys. Expandable beads are used in making foamed plastic items, largely used in some kind of packaging. Expandable beads account for about 11% of polystyrene sales and captive use, according to reports by the Committee on Resin Statistics of the Society of the Plastics Industry. Demand for these polymers has been growing faster than demand for the balance of polystyrenes, rubber-modified polystyrenes.

Polystyrene takes about two thirds of styrene use



Total 1988 U.S. consumption = 7.9 billion lb

a Includes expandable beads. b Acrylonitrile-butadiene-styrene; styrene-acrylonitrile. c Styrene-butadiene rubber. **Source:** C&EN estimates

Rubber-modified polystyrenes contain varying amounts of polybutadiene rubber, depending on the degree of impact resistance desired in the polymer. Most rubber-modified polystyrenes are molded or extruded to make nondisposables such as components of furniture, appliances, autos, toys, sporting goods, and other consumer items.

Copolymers of styrene with acrylonitrile and butadiene are a distant second as a market for styrene, at less than 10% of total use. Acrylonitrile-butadiene-styrene (ABS) resins account for more than 85% of this use, growth for which is forecast to be relatively low because of competition from other resins in many uses of ABS.

Copolymers of styrene and butadiene form another market category. Latices—often carboxylated—go largely into carpet backing and paper and textile coatings. Markets for these materials are growing at rates about equal to those for all polystyrenes.

Styrene-butadiene rubber (SBR) once dominated styrene consumption, but faster-rising demand for polystyrene long ago overcame SBR as the leader. Despite a modest increase in production expected in 1988, SBR will require less than 5% of U.S. styrene output.

Other important uses of styrene—unsaturated polyester resins and numerous other polymers—account for the rest of styrene consumption. Some of these smaller-volume resins are growing at rates above 5% annually, but their total consumption is so small that they will have minor impact on styrene demand for quite some time. □